(Semester VI)

Paper 16: ADVANCED CELL AND MOLECULAR BIOLOGY

THEORY

Unit 1: Protein trafficking in cell. **(6 lectures)**

Unit 2: Transport of molecules between the nucleus and the cytosol. **(2 lectures)**

Unit 3: Receptor mediated transport (endocytosis). **(2 lectures)**

Unit 4: Cell signaling

Signal transduction mechanisms in plants: An overview of signaling molecules; Nitric oxide an intracellular signaling molecule; Receptors for signaling molecules in plants; Protein degradation in plant signaling pathways; Integrated signal transduction, phytochrome signaling pathways. **(6 lectures)**

Unit 5: Molecular motors and their role.

Kinesin, dyneins, myosins **(3 lectures)**

Unit 6: Regulation of cell cycle **(3 lectures)**

Unit 7: DNA repair mechanisms

Photoreactivation; Repair in dark **(2 lectures)**

Unit 8: Regulation of transcription in prokaryotes and eukaryotes

Principles of transcriptional regulation; Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in *E.coli.* Eukaryotes: transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing. **(8 lectures)**

Unit 9: Translation (Prokaryotes and eukaryotes)

Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis; Post-translational modifications of proteins. **(10 lectures)**

Unit 10: Regulatory RNAs

Riboswitches, RNA interference, miRNA, RNAi, Regulatory RNA in dosage compensation (mechanism of X-inactivation). **(6 lectures)**

PRACTICALS

1. Preparation of cheek cell smears to observe Barr bodies.
2. Preparation of LB medium and raising *E.Coli.*
3. Study of antibiotic resistance in *E.Coli.*
4. Isolation of genomic DNA from *E.Coli.*
5. Study of structure of transfer RNA : 2D and 3D through photographs.
6. Study of special chromosomes- Lampbrush and Salivary gland chromosome.
7. To calculate mitotic index and duration of stages in mitosis in temporary preparation of normal and colchicine hinted micrographs showing movement of proteins through endomembrane system.

ESSENTIAL READINGS

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics. John Wiley & Sons. Canada. 8th edition.
2. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
3. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley & Sons Inc. U.S.A. 5th edition.
4. Karp, G. (2010). Cell Biology. John Wiley and sons, U.S.A. 6th edition.